Space Weather Technical Forecast

Issued on Wednesday, 29 May 2024 at 13:22 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Ongoing likelihood of M-class flares, and chance of isolated X-class flares.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Moderate with four M-flares, mostly from AR3697 in the southeast, although the largest flare came from AR3691 in the northeast, peaking at M1.8 at 29/1121 UTC. Of the nine sunspot regions on the solar disc, these are the main two of interest. AR3691 is a moderately sized region with a weak delta spot and some slow ongoing development. AR3697 in the southeast was the source of the X2.8 flare on 27 May from around the limb, and has continued to gradually rotate onto the Earth-facing disc. This is still difficult to fully assess, but does show some mixing of magnetic polarities and continues to have bright and extensive magnetic looping evident above the region in SDO imagery.

There were no Earth-directed CMEs observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds were indicative of slow wind conditions, with background speeds observed by ACE at L1, around or below 350km/s, and density near or below average. Interplanetary Magnetic Field (IMF), Bt, was mostly weak, but did become occasionally moderate from 29/0815 UTC, ranging over the whole period between 2-9nT. The north-south component, Bz, was predominately positive (northward), ranging between -1nT to +8nT. Phi angle was positive (away from the Sun) throughout. Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 (greater than 10 MeV) remained at Background. High energy electron flux (greater than 2MeV) at GOES16 varied between Background and Moderate. Associated 24-hour fluence remained steady and below the Active threshold. Observed fluence at 29/0000 UTC was 7.5e6 integrated pfu.

Four-Day Space Weather Forecast Summary
Solar Activity: Moderate to High activity is expected with a likelihood of M-class flares, and a chance of isolated X-class flares. These most likely from the active sunspot region in the southeast, AR3697, but also potentially from AR3691 in the northeast.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Background winds are expected to persist with no notable enhancements currently forecast through the period. Geomagnetic activity is forecast to be mainly Quiet with a slight chance of Unsettled intervals.

Energetic Particles / Solar Radiation: High energy proton flux is expected to be at background throughout, with only a slight chance that any flaring from the current active sunspots will lead to observable high energy protons at Earth. High energy electron flux is also forecast to persist at mainly background. The associated 24 hour fluence is expected to remain below Active.

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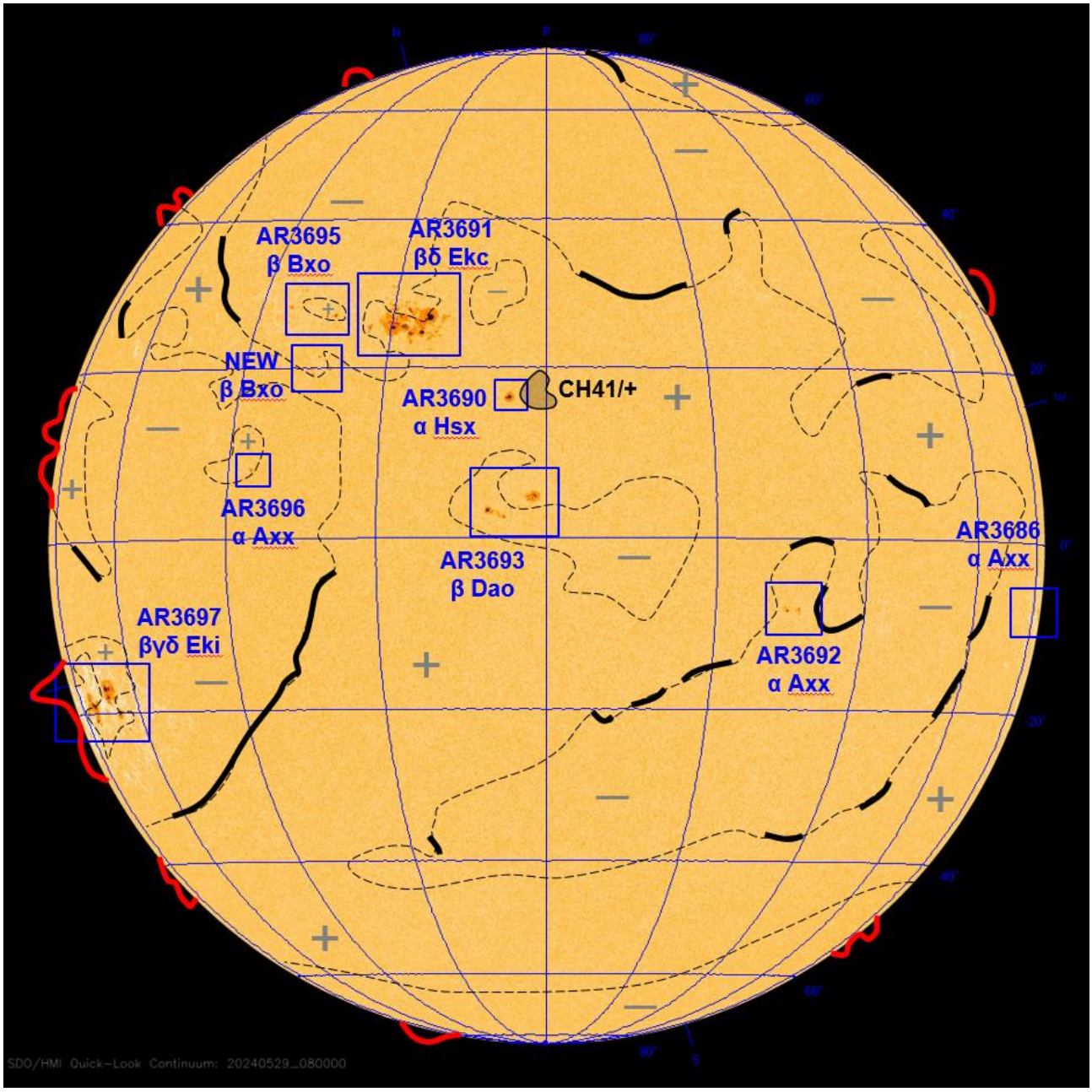
Figure 1. Solar Analysis Valid 29/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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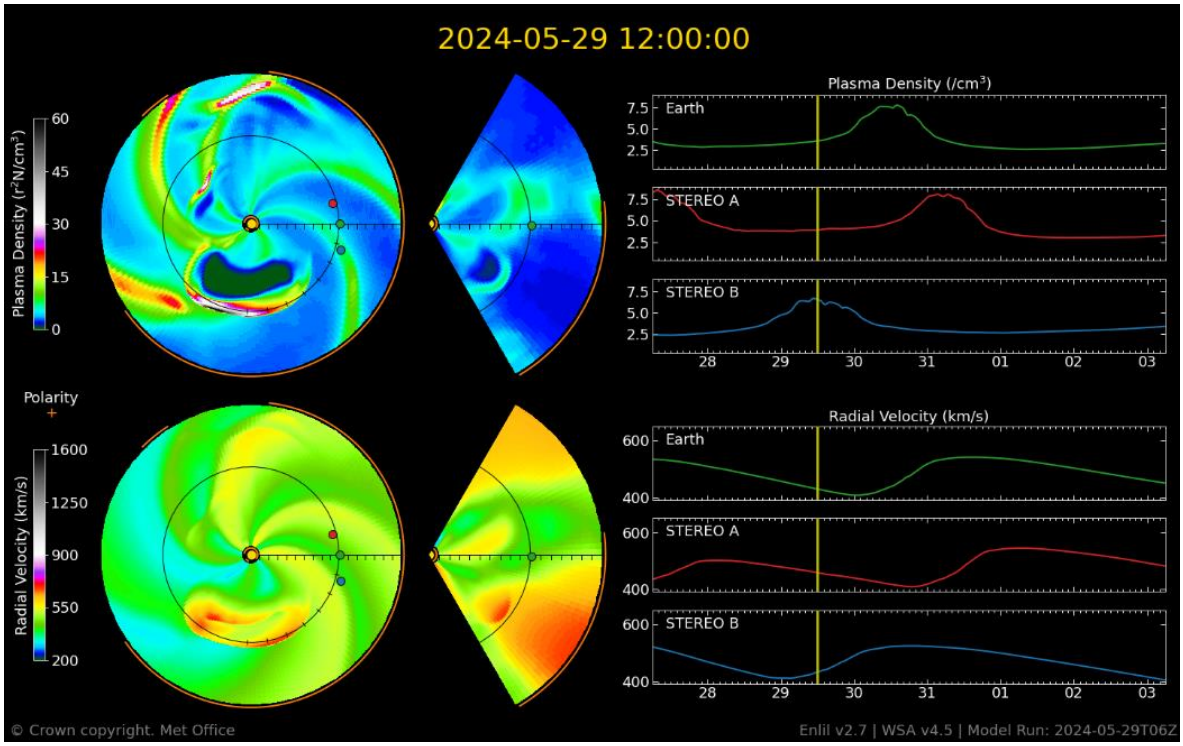
Geomagnetic Storms:
There are no Earth-directed CMEs.

Solar winds are likely to persist at background through the period, with no notable coronal hole enhancements expected. CH40/+ on the southwest disc may have weakly connected to Earth, with a small uptick in wind speeds observed from 29/0400 UTC onwards. This doesn't appear to be giving much in the way of geomagnetic activity at Earth, and will be moving further away from an Earth-effective position over the coming day.

Geomagnetic activity is expected to be mainly Quiet (Kp 0-2), with only a slight chance of Unsettled (Kp 3) intervals.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: MOSWOC Enlil. Coronal hole influences suggested by Enlil on 31May/01 Jun likely overdone, with CH on previous rotation now much reduced in size.



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Radio Blackouts - X-Ray Flares:
Moderate to High activity likely with two notable sunspots now on the Earth-facing disc, giving a likelihood of isolated M-class flares and a chance of isolated X-class flares.
AR3691 in the northeast is the easiest to assess, as a moderate size group with some mixing of polarity to cause a weak delta configuration. Despite some slow development, and the available potential energy within the group, the region has remained stable with only a few low C-flares observed in the last 24 hour.

The most active group has been AR3697 in the southeast, formed from the remnants of hyperactive ex-3664. This appears smaller and perhaps less complex that that group, however a full analysis remains difficult due to its limb location. The region does appear to have some mixing of polarities however, and given the recent X-flare on 27 May and M-flares over the past 12 hours, coupled with the original activity 14 days ago, further M-class or X-class flares remain possible.

The other regions on the Earth-facing disc are much small and simpler, and pose less of a potential for notable flare activity.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	75	70	60	60
Very Active	R3 to R5 X Class	No	25	25	20	20

Figure 3: GOES 16 & 18 X-ray flux.

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Solar Radiation Storms - (High Energy Protons):
GOES-18 proton flux is currently expected to persist at background, with only a slight chance of rising towards the S1 threshold given any further notable flares. These are most likely from either AR3697, which is currently close to the southeastern limb, or AR3691 in the northeast disc. Eastern disc flare locations are much less likely result in an increase to the observed proton flux at Earth, as protons have a tendency to follow the Parker Spiral, however, sufficiently energetic events still have the potential to be observed.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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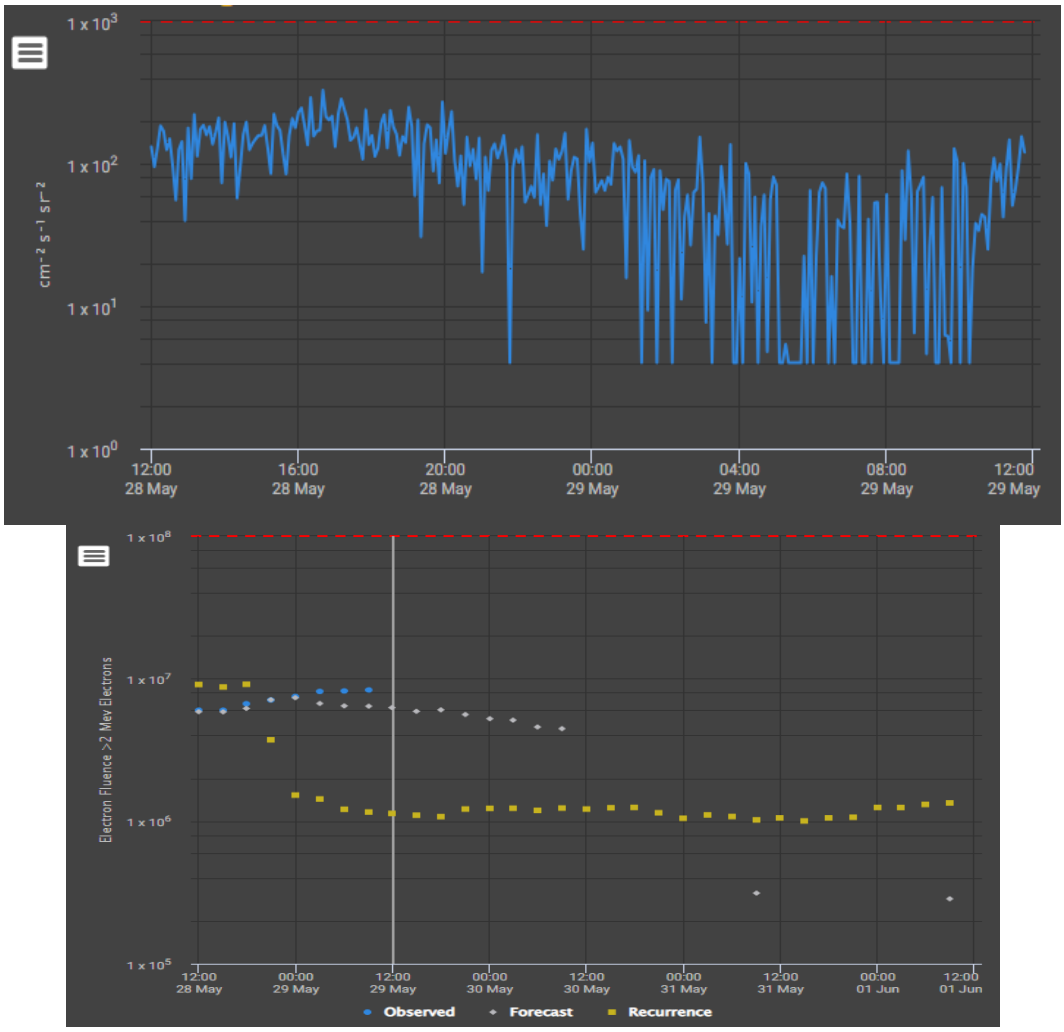
High Energy Electrons Event (≥ 2MeV):
GOES-16 electron flux is expected to remain mainly at background with brief diurnal increases to Moderate, and no significant sources of enhancement anticipated. The associated 24 hour electron fluence is expected to remain below the Active level, as supported by MOSWOC REFM, which is giving good guidance for the expected trend through the period.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: GOES 16 Electron flux and MOSWOC REFM



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